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Executive function moderates the relationship between latitude and personality

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Abstract

Previous research has examined the factors affecting individuals' personality mainly from two perspectives—the internal factors and external factors. External factors included the influence of geographical factors such as latitude, temperature, and farming style, while internal factors included individuals' cognitive capacities such as executive function. However, few studies have combined internal and external factors and examined their interaction effects on personality. The current study sought to test the role of executive function in personality under the environmental factor and to examine how they interact and shape personality. Overall, the data fit the model well. Results indicated that the interaction of latitude and moderate inhibition control predicted personality scores, such that individuals with moderate inhibition control had a stronger effect of latitude on dimensions of personality. It was also found that the interaction of low working memory and latitude predicted personality scores, such that individuals with low working memory had a stronger effect of latitude on dimensions of personality. These results suggest that the executive function may exert the moderating effect in latitude on personality by attenuating or increasing the correlation.

Keywords: personality; executive function; latitude; moderation

1. Introduction

Personality refers to individual's specific and consistent patterns of thinking, behaving, and feeling (Funder, 2016). It is influenced by the external environment and the individual's internal factors. Over the past two decades, researcher have been explored the effect of the external environment in personality such as the latitude, temperature, and farming style. They found that the individual's difference in personality among those geographic factors. The previous study demonstrated that the latitude was significantly correlated with the personality. Individuals who lived in higher latitude were more extravert and less conscientious than who lived in lower latitude (Allik & McCrae, 2004). Another study appeared that individuals who lived in the rice-farming cultures, tended to holistically thinking and acting collectively and interdependent, while who lived in the wheat farming cultures tended to think and act in the opposite way (Talhelm, 2014). Except for the latitude and farming styles, the temperature was tested as a significant factor for predicting personality (Wei et al., 2017). The study had revealed that compared with individuals who grew up in the regions with less clement temperature, who grew up in regions with more clement temperature (close to 22°C), scored higher on personality factors related to extraversion, agreeableness, conscientiousness, emotional stability, and openness. To connect these lines of research, results indicated that the external factors (latitude, farming style, temperature) affected individual's personality trait. However, except the external factor, the internal factor such as cognitive ability also place an important role.

The cognitive abilities are referred to individual's ability to acquire and process information. It will affect the thinking, emotion, motivation, and behavior. Executive function

(EF) is one of the cores and fundamental cognitive abilities. The EF encompasses a set of higher-order cognitive processes involved in regulating attention, thoughts, emotion, motivation, and actions (Miller & Cohen, 2001). The EF involved included three separate but related core system: inhibition control, cognitive flexibility, and working memory. (Miyake, 2012). The inhibition control refers to the individual's ability to overcome the internal advantage reaction tendency in attention, behavior, thinking, and emotion. It engage to make adaptive or needed behavior and enable individuals to choose and change how they respond to external stimuli rather than dominated by habits. The cognitive flexibility consisted of considering problems from different perspectives, conventional restriction and thinking ways about problems. To admit the mistakes and take advantage of fleeting and unexpected opportunities, the cognitive flexibility was also reflected in the ability of adjusting ourselves to the changes of needs (Diamond, 2013). Working memory (also referred to as updating) is a capacity-limited mental workspace that enable the maintenance and simultaneous processing of currently active information. It has been theorized that different levels of the inhibition control and working memory are correlated with an individual's personality such as conscientiousness, neuroticism, and extraversion. For example, Murdock (2013) consider that the inhibition control was positively correlated with an individual's conscientiousness and agreeableness. Waris (2018) revealed that working memory is negatively correlated with an individual's neuroticism and openness.

Individuals have variant abilities to regulate their thought, emotion, and behavior. They need to resist temptation and control their impulse and urges. Executive function is a set of general-purpose control mechanism, it regulates the dynamic of human cognition and

behavior. EFs are a core component of self-regulation and self-control ability, which affect the personality traits. (Hofmann, 2012; McCrae, 2010). There was, however, no evidence for the interaction effect between latitude and EFs in individual's personality from previous research. The current study sought to examine the EFs role in correlation between latitude and personality. This represent an important addition to the literature as it may inform how internal factor affect individuals' personality at environmental factor. Of note, in order to examine whether the effect of EFs affect this relationship, all three domain (inhibitory control, cognitive flexibility, and working memory) were included in the current study. Based on the limited extant literature linking latitude and personality, we hypothesized that EFs may exert moderate effect in the correlation between personality and latitude.

2. Material and methods

2.1 Participants

Participants were 127 university students (male = 53, female = 74) with the age 17 to 27 ($M = 20.14$, $SD = 1.89$). All were recruited from the SONA system of the University of Macau. They completed all tasks in a quiet room at a laboratory by a trained experimenter. The written informed consent was obtained from each participant. The coding for the demographics included age, gender, and birthplace. All the procedures were approved by the University of Macau Ethics Panel (see details in the appendix).

2.2 Instruments

The BFI - 44 items scale of the Chinese version. (Huang, 2003) was developed by Goldberg (1993) for individual assessment on the big five factors of personality: extraversion, agreeableness, conscientiousness, neuroticism, openness to experience. The Chinese version

of the BFI inventory includes 44 items, which were used in this present study (Lawrence, 1999). Participants rated how they agreed with the described situation (1= strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree) using the five-point Likert scale. The questions describe the extraversion such as “I see myself as someone talkative” and the agreeableness such as “I see myself gets helpful and unselfish with others”. The Higher scores indicated a higher level of the personality trait. (See detailed in appendix)

2.3 Executive function experiment

2.3.1 Simon task

Overall, the response accuracy of participants in the Simon task is 96.05 %. At the beginning of 20 neutral trials, there was the presentation of a center fixation (+) for 500ms. The center fixation was immediately followed by the target stimulus as either “right” or “left”. If participants see the word “left”, they need to press the Z key to respond. If they see the word “right”, they need to press the M key to respond. The participants’ task was to press the corresponding key as quickly as possible without errors. There were two types of tests in this experiment. The first type was called the congruent test. In this test, the word “left” would display on the left side of screen. The word “right” would display on the right side of the screen. The second type of test was called as the incongruent test. In this test, the word “left” may show on the right side of the screen and the word “right” may show on the left side of the screen. Each Simon block consisted of 40 congruent trails and 40 incongruent trails which were presented in random order. Half of the trail of each type presented the target on the left with the other half presented the target on the right. Thus, the mean response time (RT) for the four conditions was defined by the combination of two blocks. The two levels of

congruence (congruent vs. incongruent) were each based on trial and collapsed across the blocks on 80 trials (Paap & Greenberg, 2013). The computer will record the response time and accuracy for two tests from participants automatically. The value of incongruent response the time minus. The congruent time represents the individual's inhibitory ability. The smaller the value is, the stronger inhibitory control individuals have.

2.3.2 Color-shape switching task

Overall, the response accuracy of participants in the Color-shape task was 92.47 %. Each trial began with the presentation of a center fixation (+) for 350 ms and then a blank screen for 150 ms. In the pure color block, the participants' task was to press the "Z" when the target was blue and the "X" key was red. In a pure shape block, if the target was a circle, the task was to "K". If it was the triangle, the key was "L". The target set consisted of a blue circle, a blue triangle, a red circle, and a red triangle.

In a mixed block, the target was preceded by a precue for 250 ms, which remained in view until the participants' response to the target. If the precue was a rainbow, then the participant had to make a color decision when the target appeared. If the precue was a blue circle embedded within a blue triangle, the participants had to make a shape decision when the target appeared. Participants were instructed to respond quickly when they could base on the precue dimension (color or shape). Each trial was designed as a "repeat" trial if the cued decision was the same as on the previous trial and a different "switch" trial.

The task comprised 6 blocks. The first block of 16 trials was "pure" color. Each of the four targets appeared four times in random order. The second block of 16 trials was "pure" shape with each of the targeted appearing in random order. The following Block 2 of the

“mixed” task was introduced with detailed instruction. The use of the precue to sign whether a color or shape would be required on each specific trail. Each of the four “mixed” blocks started with two buffer trials which were not analyzed. Block 3 was a practice block and comprised 18 trails (including the two buffers). Block 4, 5, 6, each comprised 50 trials (including two buffers). A single random order was used for every participant. Each of the four targets appeared 150 times across Block 4 to 6. There were 72 repeat trials and 72 switch trials. The value of response time for repeat trial minus represents the cognitive flexibility. The smaller the value is, the stronger cognitive flexibility individuals have. (Paap & Greenberg, 2013).

2.3.3 Letter-memory (working memory) task

Overall, the accuracy of participants in letter-memory task is 95.05 %. In the letter-memory task, the participants were presented with a series of letters sequences. For the purpose of ensuring the participants constantly updated contents of working memory, they were required to say out loudly about the last three letters after each letter presented. There are a totally of 15 letter sequences. The accuracy of the reminiscence letters at the end will be measured dependently. It reflected the ability of participants’ updating. For example, if they recall 13 letter sequences accurately in 15 letter sequences, the accuracy would be 80 %. The more accuracy of the recalled letter was, the stronger working memory ability the individuals had. (Miyake, 2012).

3. Results

The high, moderate and low level of inhibition control, cognitive flexibility and working memory were computed as ± 1 SD. The data were analyzed using SPSS. The correlation

and regression analyses were conducted.

3.1. Descriptive statistics and correlation analyses

Table 1 showed the means and standard deviations of studied variables. Data were analyzed in Statistical Package for Social Sciences (SPSS) version 25. In general, the results showed that extraversion was correlated with agreeableness ($R = 0.32, p < .05$), conscientiousness ($R = 0.287, p < .05$) and openness ($R = 0.467, p < .05$). Latitude was correlated with conscientiousness ($R = 0.199, p < .05$) (see Table. 2)

Table 1.

Descriptive statistics for study variables.

Variable	M	SD	N
CF (RT)	687.0083	411.2762	127
IC (RT)	20.70355	36.13028	127
Updating	0.9505	0.09822	127
Extraversion	0.62214	0.119117	127
Agreeableness	0.719603	0.09171	127
Conscientiousness	0.64358	0.118331	127
Neuroticism	0.632573	0.117585	127
Openness	0.713997	0.108816	127
The latitude of birth	27.01032	8.630819	127

Note: CF = Cognitive flexibility, IC = The inhibition control, RT = response time, N = number of

participants

Table 2.

Correlation analysis for study variables.

	1.CF	2.IC	3.WM	4.E	5.A	6.C	7.N	8.O	9.BL
1	1								
2	0.142	1							
3	0.142	-0.078	1						
4	0.082	0.012	0.093	1					
5	0.06	-0.074	0.139	0.32**	1				
6	0.007	-0.038	0.13	0.287**	0.128	1			
7	-0.02	0.108	-0.128	-0.377	-0.372	-0.411	1		
8	0.025	-0.169	0.137	0.467**	0.127	0.154	-0.142	1	
9	0.109	-0.1	0.103	0.058	0.169	0.199**	-0.165	0.011	1

Note: CF = cognitive flexibility, IC = The inhibition control, WM = working memory, E = extraversion, A = agreeableness, C = conscientiousness, N = neuroticism, O = openness. ** $p < .01$

3.2. Moderation of inhibition control

All samples ($N = 127$) were divided into 3 groups based on the individual's level of the inhibition control. The high and low levels of the inhibition control were calculated as ± 1 SD. The high-level inhibition control ($N = 34$), moderate inhibition control ($N = 59$) and the low inhibition control ($N = 34$). In the whole sample ($N = 127$), the latitude was not significantly correlated with agreeableness ($R = 0.169$, $p > .05$). The moderate effect of

inhibition control tested is presented in Fig. 1. In the moderate group, the latitude was significantly correlated with the agreeableness ($R = 0.394$, $R^2 = 0.155$, $p < .05$). In comparison, latitude was not significantly correlated with agreeableness in the high ($R = 0.115$, $R^2 = 0.013$, $p > 0.05$) and the low groups ($R = 0.231$, $R^2 = 0.045$, $p > 0.05$). These results indicated that the high and low level inhibition control attenuated the correlation between the latitude and agreeableness.

In whole sample, latitude was significantly correlated with conscientiousness ($R = 0.199$, $R^2 = 0.155$, $p < .01$). The moderate effect of inhibition control tested is presented in Fig. 2. The moderate group revealed that latitude was significantly correlated with conscientiousness ($R = 0.282$, $R^2 = 0.079$, $p < .05$). In contrast, latitude was not significantly correlated with conscientiousness in the high ($R = 0.028$, $R^2 = 0.01$, $p > .05$) or low group ($R = 0.185$, $R^2 = 0.134$, $p > .05$). This revealed that the low or high-level of inhibition control attenuated the correlation between the latitude and conscientiousness.

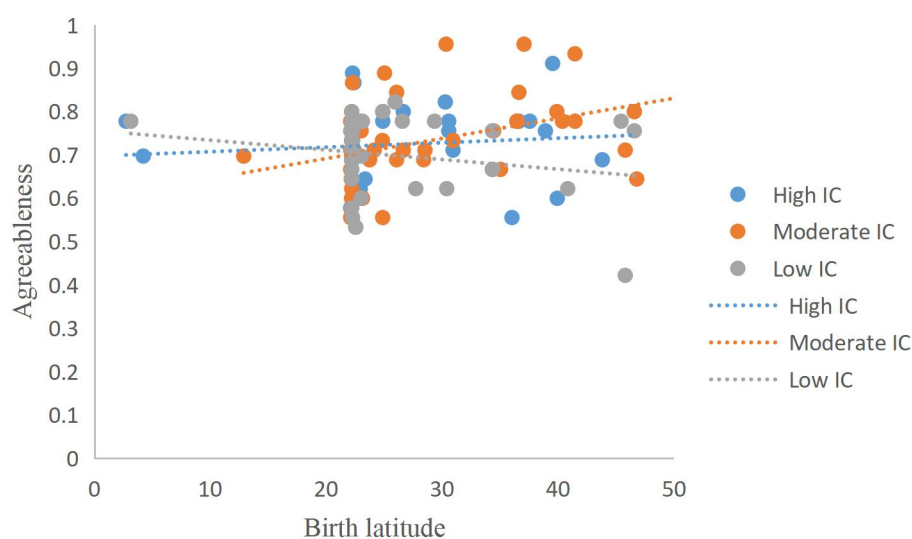


Fig. 1. The interaction of latitude and inhibition control correlate with agreeableness. Latitude

significantly correlate with agreeableness with moderate inhibition control. $p < .01$, $R^2 = 0.155$

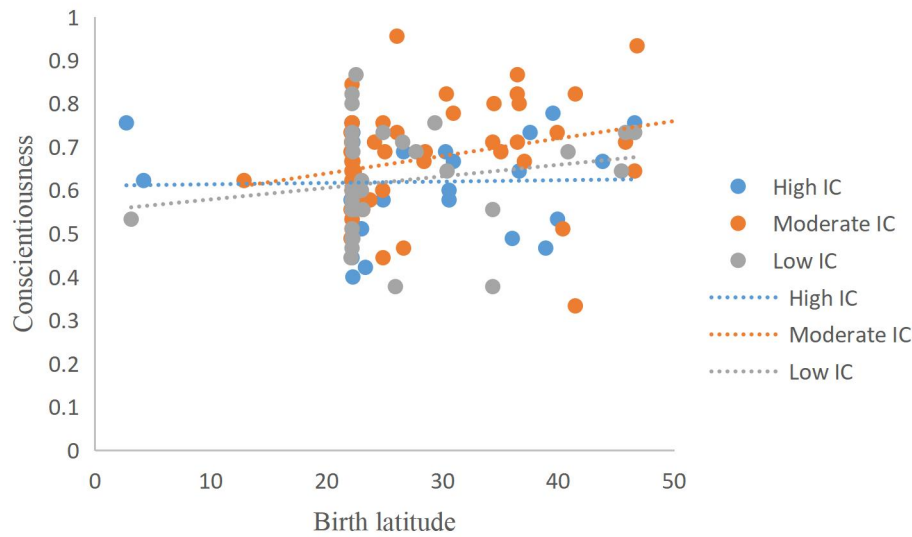


Fig. 2. The interaction of latitude and inhibition control correlated with conscientiousness. Latitude significantly correlated with conscientiousness with moderate inhibition control. $p < .05$, $R^2 = 0.079$.

3.3 Moderation of cognitive flexibility

In low group, the latitude was not significantly correlate with extraversion ($R = 0.269$, $R^2 = 0.073$), agreeableness ($R = 0.178$, $R^2 = 0.032$), conscientiousness ($R = 0.243$, $R^2 = 0.059$), neuroticism ($R = 0.222$, $R^2 = 0.049$) and openness ($R = 0.094$, $R^2 = 0.009$). In moderate group, the latitude was not significantly correlate with extraversion ($R = 0.043$, $R^2 = 0.002$), agreeableness ($R = 0.139$, $R^2 = 0.019$), conscientiousness ($R = 0.201$, $R^2 = 0.04$), neuroticism ($R = 0.137$, $R^2 = 0.019$) and openness ($R = 0.077$, $R^2 = 0.006$). In high group, the latitude was not significantly correlate with extraversion ($R = 0.054$, $R^2 = 0.01$), agreeableness ($R = 0.187$, $R^2 = 0.035$), conscientiousness ($R = 0.143$, $R^2 = 0.02$), neuroticism ($R = 0.191$, $R^2 = 0.037$) and neuroticism ($R = 0.108$, $R^2 = 0.012$). The results appeared that cognitive flexibility may not exert the moderate effect in these correlation.

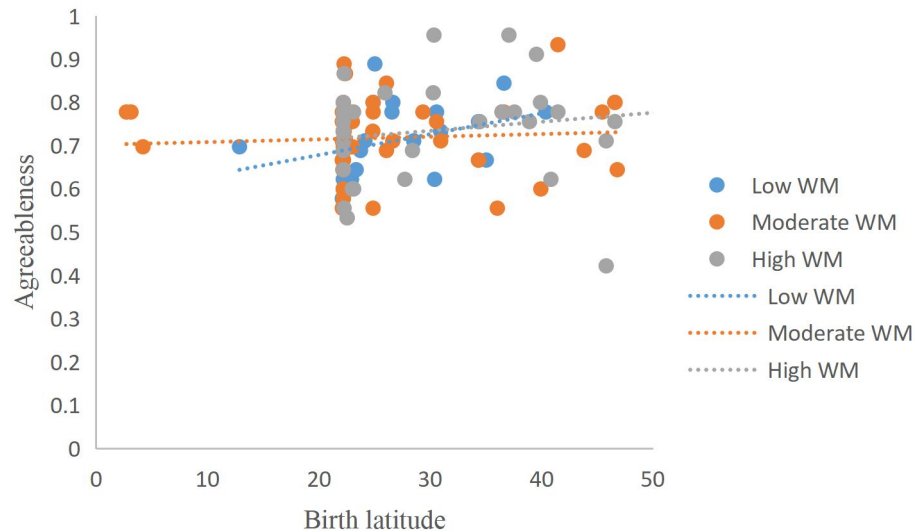


Fig. 3. The interaction of latitude and working memory correlated with agreeableness. Birth latitude significantly correlated with agreeableness with low working memory. $p < .05$, $R^2 = 0.149$.

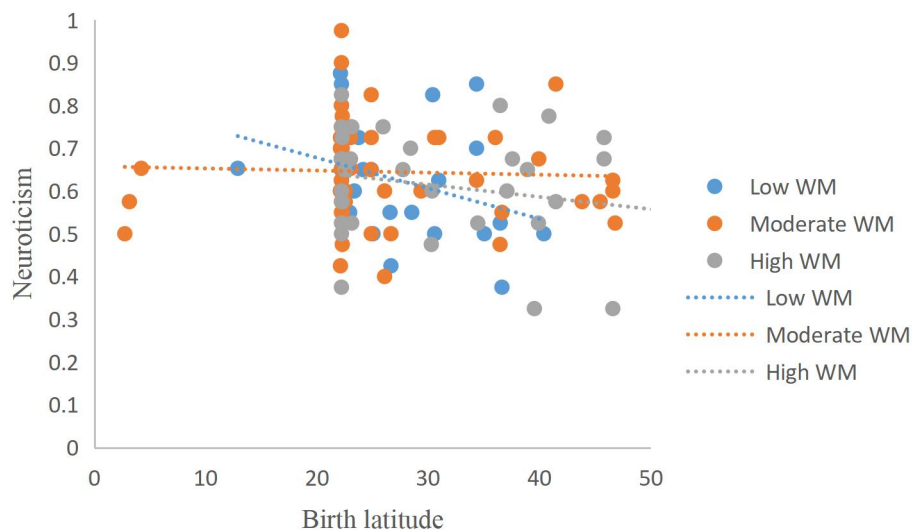


Fig. 4. The interaction of latitude and working memory correlate with neuroticism. Birth latitude is significantly correlate with neuroticism with low working memory. $p < 0.05$, $R^2 = 0.124$.

3.4. Moderate effect test: working memory

In the whole sample, the latitude was not significantly correlated with the agreeableness ($R = 0.169$, $R^2 = 0.028$, $p > .05$). The moderate effect of working memory tested is presented

in Fig. 3. In the low groups, the latitude was significantly correlated with agreeableness ($R = 0.385$, $R^2 = 0.149$, $p < .05$). In contrast, the latitude was not significantly correlated with agreeableness in the high ($R = 0.166$, $R^2 = 0.028$, $p > .05$) or moderate group ($R^2 = 0.004$, $p > .05$). The results revealed that low working memory enhanced the correlation between the latitude and agreeableness.

In whole sample, the latitude was not significantly correlated with the neuroticism. ($R = 0.165$, $R^2 = 0.027$, $p > .05$). The moderate effect of working memory tested is presented in Fig. 4. In low groups, the latitude was significantly correlated with neuroticism. ($R = 0.352$, $R^2 = 0.124$, $p < .05$.) In contrast, the latitude was not significantly correlated with neuroticism in the high ($R = 0.172$, $R^2 = 0.03$, $p > .05$) or moderate group ($p > .05$, $R^2 = 0.002$). The results revealed that the low working memory enhanced the correlation between the latitude and neuroticism.

4. Discussion

The purpose of current study was to investigate the relation between EFs, latitude, their interaction and personality. Based on the previous research and theory, we hypothesized that latitude, executive function, and their interaction moderate the correlation between the latitude and personality. Results partially supported these hypotheses. Overall, the data fit the model well. Latitude, moderate inhibition control, and their interaction explained 15.5% variance in agreeableness, and 7.9% of the variance in conscientiousness. Latitude, low working memory, and their interaction explained 14.9% in agreeableness, and 12.4% of the variance in neuroticism. Results did not support the hypothesis that cognitive flexibility would moderate the correlation between latitude and personality. It is possible that both

cognitive flexibility and latitude exert smaller than expected effects on dimension of personality. Additionally, our sample characteristics may have influenced these results, the unique and stronger effect may be observed in more diverse and clinical samples. However, results did support the hypothesis that the interaction of (inhibition control / working memory) and latitude would predict personality. Combined, we got two results. First, the high and low level of the inhibition control attenuated the correlation between the latitude and personality. Second, the low levels of working memory enhance the correlation between the latitude and personality. In the following section, we try to explain the moderation effect of the inhibition control and working memory.

4.1. Moderation effect: inhibition control

The moderation effect of the inhibition control can be explained by the inhibition of a proponent response. The inhibition of a proponent response helped individuals to inhibit the impulsivity or habit, which was not compatible with social norms and directed goals. (Hall, 2013) The process of the inhibition control helped the individuals to inhibit hostile thought and uncooperative behaviors which was opposite to the cooperation and social harmony (Roberts et al., 2009). Individuals who are high in the inhibition control maintain agreeableness, can attenuate the effect of the latitude in agreeableness and conscientiousness and moderate this correlation (Graziano & Eisenberg, 1997).

4.2. Moderation effect: working memory

The moderate effect of working memory can be explained by the self-regulation of the down regulation process of unwanted affect and carving process and the suppression of ruminative thoughts (Kane et al., 2007). The downregulation of the unwanted effect and the

process of craving help the individual to regulate emotion such as suppression of anger under the tempting stimulus (Hofmann et al., 2008). The process of thought for suppression helps the individuals to regulate their impulsive and hostile thought under the stimulus from the environment. Individuals who are high in working memory maintains the agreeableness and attenuated the effect of the latitude and moderate its correlation.

Summarized, if individual's EFs are high, the personality is hardly influenced by the latitude (external environment) and the effect of personality with the latitude will be attenuated. If EFs are low, the personality is easily influenced by the latitude, the effect of personality with the latitude will be ascent.

In conclusion, we combined the executive function and personality in correlation analysis with latitude. The results revealed that an individual's difference in the levels of executive function (inhibitory control and working memory) moderated the correlation between the latitude and personality. The inhibition control and the working memory attenuated the correlation through the influence in the individual's personality trait. Our hypothesis was examined. It is reasonable to propose that individual's difference in executive function is the reason which appeared the moderate effect in these correlation. In general, the current researches find the latitude factors (distance from equator, temperature, agriculture style) are associated with individuals' personalities, we point out a probable antecedent that the executive function should be explicitly considered in these correlation research.

The results of current study further implicate the importance of examining the effect of multiple factors in personality. Latitude may exert significant effects on personality in individuals who have moderate or low level's executive function. As such, examining single

factors predicting personality may not yield complete results. By using multiple variables within a single model, a better appreciation of complex nature of personality development can be gained. Importantly, these theories cannot be confirmed using cross-sectional data and will need further exploration in longitudinal and causal models.

It should be noted that the current study was subject to limitations. While the current study provides early, cross-sectional evidence for the proposal mode, it is not able to confirm a causal theory. A longitudinal investigation of these factors would provide more detail on these tested variables. Another limitation was the reliance on self-report measure. The use of an independent and objective measure of personality could strength the association and remove any reporter bias present in analyses. Sample characteristics reduce the generalizability of the current finding. The sample was small and consisted primarily of 50 Macau residents and 77 residents from mainland China, Hong Kong and Taiwan. Further studies must examine these relations in a more diverse and clinical sample. Despite limitations, the results from the present study provide crucial information on the role of executive function, latitude and their interaction on the dimensions of personality. The interaction of moderate or low executive function and latitude may increase the development of individual's personality.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix

大五人格量表 BFI

这里是一些可能适用也可能不适用于你的特征。例如，你是否认为你是一个愿意花时间与别人在一起的人？请在每一个陈述旁边写下一个数字来表示你同意或不同意该陈述的程度。

- 1.非常不同意
- 2.比较不同意
- 3.既不同意也不反对
- 4.比较同意
- 5.非常同意。

- 1.是健谈的
- 2.倾向于指责别人
- 3.工作严谨认真
- 4.是压抑，忧郁的
- 5.是独创性的，不断地有新想法
- 6.是缄默的
- 7.是乐于助人和不自私的
- 8.可能有点粗心
- 9.是放松的，能很好地应付压力
- 10.对许多不同的事物感到好奇

- 11.精力充沛
- 12.挑起与他人争吵的
- 13.是一个值得信赖的工作者
- 14.可能会紧张的
- 15.是一个机灵的深入思考者
- 16.发生很多热情
- 17.有着宽大的天性
- 18. 往往没有条理
- 19.担心过多
- 20.有活跃想象力
- 21 倾向于安静
- 22 通常是信任人的
- 23 往往很懒惰
- 24 情绪稳定，不易沮丧
- 25 具有创造性
- 26 有果断的性格
- 27 可能是冷漠和冷淡的
- 28 坚持不懈直到任务完成
- 29 可能是喜怒无常的
- 30 重视艺术的审美体验
- 31 有时害羞，拘谨
- 32 为人着想，对几乎每一个人都很和蔼

- 33 做事有效率
- 34 在紧张情景中保持冷静
- 35 喜欢有规律的工作
- 36 开朗，善社交
- 37 有时对别人粗鲁
- 38 制定计划并按计划行事
- 39 容易紧张
- 40 喜欢反省，与观念打交道
- 41 几乎没有艺术兴趣
- 42 喜欢与他人合作
- 43 容易分心
- 44 擅长艺术，音乐或文学

请检查：你是否在每一个陈述前都写下了数字？

BFI 量表计分（“R”表示反向计分的题项）

外倾性：1, 6R, 11, 16, 21R, 26, 31R, 36;

宜人性：2R, 7, 12R, 17, 22, 27R, 32, 37R, 42;

责任感：3, 8R, 13, 18R, 28, 33, 38, 43R;

神经质：4, 9R, 14, 19, 24R, 29, 34R, 39;

开放性：5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

注：Oliver P. John 1991 年（郑涌译，黄希庭校）

The Big Five Inventory (BFI)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

I see myself as someone who...

- ___ 1. Is talkative
- ___ 2. Tends to find fault with others
- ___ 3. Does a thorough job
- ___ 4. Is depressed, blue
- ___ 5. Is original, comes up with new ideas
- ___ 6. Is reserved
- ___ 7. Is helpful and unselfish with others
- ___ 8. Can be somewhat careless
- ___ 9. Is relaxed, handles stress well
- ___ 10. Is curious about many different things
- ___ 11. Is full of energy
- ___ 12. Starts quarrels with others
- ___ 13. Is a reliable worker
- ___ 14. Can be tense
- ___ 15. Is ingenious, a deep thinker
- ___ 16. Generates a lot of enthusiasm

- ___ 17. Has a forgiving nature
- ___ 18.. Tends to be disorganized
- ___ 19. Worries a lot
- ___ 20. Has an active imagination
- ___ 21. Tends to be quiet
- ___ 22. Is generally trusting
- ___ 23. Tends to be lazy
- ___ 24. Is emotionally stable, not easily upset
- ___ 25. Is inventive
- ___ 26. Has an assertive personality
- ___ 27. Can be cold and aloof
- ___ 28. Perseveres until the task is finished
- ___ 29. Can be moody
- ___ 30. Values artistic, aesthetic experiences
- ___ 31. Is sometimes shy, inhibited
- ___ 32. Is considerate and kind to almost everyone
- ___ 33. Does things efficiently
- ___ 34. Remains calm in tense situations
- ___ 35. Prefers work that is routine
- ___ 36. Is outgoing, sociable
- ___ 37. Is sometimes rude to others
- ___ 38. Makes plans and follows through with them

- ____ 39. Gets nervous easily
- ____ 40. Likes to reflect, play with ideas
- ____ 41. Has few artistic interests
- ____ 42. Likes to cooperate with others
- ____ 43. Is easily distracted
- ____ 44. Is sophisticated in art, music, or literature

Scoring:

BFI scale scoring (“R” denotes reverse-scored items):

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

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